

**OSBORNE REYNOLDS'**

**SUBMECHANICS OF THE UNIVERSE:**

**A STRUCTURED CONTEXT**

**FOR MATTER, ENERGY, SPACE, TIME, AND**

**PSI PHENOMENA**

BY

Bruce Lamar Rosenberg, M.A.

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23 North Chelsea Avenue  
Atlantic City  
New Jersey, 08401 USA  
(609) 345-4712

Brues.1@comcast.net

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# **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

## **ABSTRACT**

Professor Osborne Reynolds, F.R.S. (1842-1912) was a British engineer after whom the fluid dynamics Reynolds number was named. He considered his monograph, "The Submechanics of the Universe", (1, henceforth "SMU") published in 1903, to be his greatest achievement. It advances a theory of a structured, mechanical medium which accounts for all known physical phenomena. My analysis of it shows that it is compatible with relativity, quantum theory and elementary particle theory. Although Reynolds' theory is all but forgotten today, similar theories are being proposed by some modern theoretical physicists. Reynolds' theory provides a basis for long-range order which eludes today's theorists. Current theory pictures empty space with independent particles zooming around in it. These particles interact via photons and fields. Reynolds' theory pictures a structured, quasi-crystalline medium, in which elementary particles exist as dislocations. The particles interact via vibrations and stresses in the medium. Reynolds' medium is a universal matrix within which all things exist. It is analogous to the East's "unseen ground of existence". In place of independence and chaos, Reynolds' theory provides dependency and order. Intellectual understanding of cosmic unity resonates with the experiential unity of self and makes whole what may have been disparate.

In this paper, I briefly review Reynolds' theory and show that it allows for possibilities beyond those of currently accepted theories. I will explain how this theory can provide a physical basis for understanding psi phenomena.

## **REVIEW OF OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE**

### **INTRODUCTION**

Reynolds begins his magnum opus, "Submechanics of the Universe", as follows:

"By this research it is shown that there is one, and only one, conceivable purely mechanical system capable of accounting for all the physical evidence, as we know it in the Universe. The system is neither more nor less than an arrangement, of indefinite extent, of uniform spherical grains generally in normal piling so close that the grains cannot change their neighbors, although continually in relative motion with each other; the grains being of changeless shape and size; thus constituting, to a first approximation, an elastic medium with six axes of elasticity symmetrically placed." (1, p. 1).

Reynolds' popular lecture entitled, "On an Inversion of Ideas as To the Structure of the Universe" (2) contains a nonmathematical exposition of his theory. It is a good place for beginners to start.

Let me tell you how I got started in this subject. In 1968 while employed as a research engineer at the Franklin Institute Research Laboratories in Philadelphia, Pennsylvania, USA, I invented a device which consisted of a dilatant fluid enclosed and sealed in a rubber sack. At the time I had no idea what dilatancy was, so I asked some of my associates in the physics department, got the

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

basic vocabulary and set off to the Franklin Institute Library to do some research. This was the beginning of my education in rheology and the work of Osborne Reynolds.

While researching the prior art in dilatancy, I was surprised and intrigued to find, in a book on rheology (3, p. 4), that Osborne Reynolds' had based an entire theory of the universe on a dilatant medium. I continued to pursue my applications and subsequently received a patent on a toy called the "Wackysack(R)" (4). Later, through the US Navy, I was granted a patent on an impact absorber based on the same principle (5). The rheologically dilatant suspension used in my patents has a critical shear rate which can be kinaesthetically perceived on handling it. Below a critical shear rate it behaves as a liquid, above this rate it behaves as a solid. There seemed to be some analogy between this critical flow rate and relativistic phenomena at the speed of light.

As an amateur physicist, I was thus fascinated with Reynolds' SMU model and continued to study it and related topics over the past twenty years. I have written two papers on the topic. The first deals with the theory in relation to UFOs (6) and the second with a historical perspective on the theory (7).

### **DILATANCY OF BEACH SAND, GROUND COFFEE, AND GRAVITY**

Reynolds' first aether-related works (8 and 9) appeared 18 years before publication of his magnum opus. They describe a previously undiscovered phenomenon; which Reynolds called "dilatancy". Dilatancy refers to the shear-induced expansion of a mass of solid particles. Reynolds' used dilatancy to explained the curious behavior of beach sand. Walking on the beach is easy on the wet sand near the water, but difficult in dry sand. When walking on wet beach sand, each time a heel strikes the surface, the area surrounding the impact appears to turn dry or white. This dry area appears to propagate from the point of impact like some sort of field. According to Reynolds (2), it is in many ways analogous to a gravitational field.

When a close-packed mass of sand is subjected to a deforming force, the particles attempt to slide past one another. This results in an expansion or dilation of the deformed volume. The action of expansion or dilation can be understood by making two fists, holding them in front of you and placing the knuckles of one fist into the spaces between the knuckles of the other fist. Your knuckles should now be "geared" to each other with the open spaces (interstices) at a minimum. Now, if one set of knuckles is moved up or down relative to the other, a point of maximum open "packing" is reached then the top of one knuckle is directly on top of another. This represents the maximum expansion or dilation of the volume containing the sheared "particles", i. e., knuckles.

In sand, for the sheared volume to expand, water must flow in to fill the interstices. The sheared portion of sand underfoot therefore sucks water away from the surrounding mass of wet sand and its surface turns white or dry. This gearing action is responsible for the strength of the sand and also for the rigidity of bricks of coffee packaged in flexible plastic foil bags. Once the vacuum is broken, particles of coffee are no longer compressed or interlocked and the brick becomes a floppy bag. Once the water is gone from between the sand grains, the once solid surface

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

becomes a soft, leg-tiring treadmill. Although dilatancy is the key element in the SMU theory, there is more to it than dilatancy.

### **DETAILED EXPLANATION OF REYNOLDS' THEORY**

Reynolds' medium is granular, composed of uniform, independent, spherical grains much smaller than subatomic particles and filling the entire universe. In fact, it is the universe. In matter-free space the grains are hexagonally arrayed and almost touching (close-packed). Because they cannot normally exchange neighbors, they form a quasicrystalline matrix. The grains are in relative, vibratory, gas-like motion; but with a mean free path many orders of magnitude smaller than the diameter of the grains (unlike a gas). This jostling of the grains against one another produces a very high pressure in the medium. Because of the gearing of the grains and the pressure, the medium supports transverse disturbances (light waves) whose local propagation rate depends on the local pressure and strains in the medium.

Reynolds says matter is strained regions of misalignment of the grains or "singular surfaces", "negative inequalities", or simply, "holes". Elementary particles are stable, dynamic configurations of holes; of places where the aether grains are missing from the quasicrystalline matrix. Matter, then, moves by means of displacement; much as a bubble moves upward by an equal amount of liquid being displaced downward. For holes to move through the medium, aether grains must move in the opposite direction. Disturbances are propagated by the aether grains instantaneously transferring their momentum by means of perfectly elastic collisions among them. It must be emphasized that the hypothetical aether grains are idealized and must not be thought of as ordinary matter.

The presence of holes in granular medium causes a reduction in the local aether pressure. This reduction in pressure corresponds to gravitational and inertial effects of matter. It is an inward, centrally acting strain gradient in the medium. Two pieces of matter move toward each other because the aether between them tends to move away at right angles from a line connecting them. Said differently, matter tends to move toward regions of lower aether pressure due to the higher pressure of the surrounding aether.

In explaining gravitation with the SMU model, Reynolds writes (1, p. 3):

"Efforts, proportional to the inverse square of the distance, to cause two negative inequalities to approach are the result of those components of the dilatation (taken at first approximation only) which are caused by the variation of those components of the inward strain which cause curvature in the normal piling of the medium. The other components of the strain being parallel, distortions which satisfy the condition of geometrical similarity do not affect the effort. If the grains were indefinitely small, there would be no effort. Thus the diameter of a grain is the parameter of the effort; and multiplying this diameter by the curvature of the medium (underlining by B.R.) and again by the mean pressure of the medium the product measures the intensity of the effort. The dilation diminishes as the centers of the negative inequalities approach, and work is done by the pressure in the medium, outside the singular surfaces, to bring

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

the negative inequalities together. The efforts to cause the negative inequalities to approach correspond, exactly, to gravitation, if matter represents negative mass."

Reynolds then shows the calculation which results in the model's correct prediction of gravitational force at the surface of the earth, concluding:

"The inversion is thus complete. Matter is an absence of mass, and the effort to bring the negative inequalities together is also an effort on the mass (aether grain mass, that is, B.R.) to recede. And since the actions are those of positive pressure there is no attraction involved; the efforts being the result of the virtual diminution of the pressure inwards."

As underlined above, Reynolds spoke of gravitational curvature of space more than a decade before Einstein's general theory of relativity was published.

### **HOW MATTER MOVES FREELY THROUGH REYNOLDS' MEDIUM AND VICE VERSA**

Reynolds' theory differs greatly from aether theories based on the solid-elastic continuum model. Two requirements for the solid-elastic medium are: 1) to be stiff enough to transmit the extremely high frequency vibrations of light on the one hand, yet 2) diaphanous enough to permit the unhindered movement of the heavenly bodies. According to Reynolds' his SMU model avoids these paradoxical requirements (1, p. 250):

"The difficulties in conceiving the free motion of the ether through matter do not present themselves in the analysis of the properties of the granular medium as now accomplished. This follows from the analysis which has been effected in this and the previous section."

"...Whence it follows that the singular surfaces which correspond to matter are free to move in any direction through the medium without resistance, and vice versa the medium is free to move in any direction through the singular surfaces without resistance. And that the waves corresponding to those of light are instituted and absorbed by the singular surfaces only. So that after institution at the place where the singular surfaces are, the motion of the waves depends solely on the mean motion of the medium, and the rate of propagation is equal in all directions until they again come to singular surfaces. Thus all paradox is removed and the explanation of aberration is established on the basis of the absence of any appreciable resistance to the medium in passing through matter."

"Thus besides the explanations by definite analysis of:  
the potential energy,  
the propagation of transverse waves of light,  
the apparent absence of any rate of degradation of light,  
the lack of evidence of normal waves,

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

the gravitation of matter,  
electricity,  
which explanations render the purely mechanical substructure of the universe  
indefinitely probable, we have by further analyses obtained ..."

Reynolds' theory is compatible with both relativity and quantum theories. It is an aether which was not demolished by the Michelson-Morley (M-M) experimental results. It is true that M-M results disproved some aether theories; but far from being disproven, I have actually been able to show that the mechanism whereby relativistic phenomena occur is inherent in the very structure and dynamics of Reynolds' medium itself (6 and 7).

### **MODERN PHYSICS AND REYNOLDS' THEORY**

Some modern theoretical physicists, notably Bohm (10), de Broglie and Vigier (11) and Hiley (12), have postulated the existence of a subquantum medium, which according to Bohm's early interpretation, is surprisingly similar to Reynolds' quasicrystalline dilatant medium. Both theories envision a structured matrix with a graininess much finer than the smallest subatomic particle. In Bohm's subquantum medium, elementary particles are analogous to dislocations and disclinations in a crystalline matrix. That is, there are a sufficient number of different types of dislocations and disclinations in crystals to account for the number of types of known elementary particles. The stress fields in the crystal are analogous to the electric, magnetic, nuclear, or gravitational forces exerted by the particle. The particle cannot exist without the stress fields nor the stress fields without the particle. Frank (13, pp. 131-134) has shown in a theoretical analysis that a Burgers screw dislocation moving through a crystal experiences relativistic effects, which can be determined by substituting the transverse velocity of sound in the crystal for the speed of light. Thus, there is a modern trend moving in the direction of Reynolds' theory.

Moving, propagating dislocations have much in common with the objects in John Conway's game of Life. The objects in the game of Life are called "cellular automata". It's not really a game, it's more a self running demonstration or simulation usually played out on the screens of personal computers. Certain rules are set up on a computer, an initial configuration is input, and the action is begun on the playing field. Stable and oscillating immobile entities arise and some rarer moving entities, called gliders and boats also appear on the field as the configuration evolves. Certain starting configurations called "glider guns" are immobile oscillators which every so many cycles shoot out a glider onto the field.

Although much simpler, in some respect Conway's 2 dimensional objects are analogous to elementary particles in Reynolds' aether. In both cases, from a set of relatively simple initial assumptions and generating rules, an entire universe is constructed. Le Corbeiller (14, p. 881) believes that, in light of the 32 possible crystal classes and the 230 possible types of space arrangements of atoms in a crystal, "It may not be very long before we obtain deductive knowledge, on the basis of some few fundamental assumptions, of the main features of the physical universe."

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

A proposal that one might deduce definable, mechanical structures for elementary particles on a subquantum scale should cause Heisenberg to spin in his grave. Heisenberg's uncertainty principle sets limits to certain kinds of knowledge. It is a fuzzy electron which is measured by photons. It is a fuzzy airplane which is measured by radar pulses. For certain purposes an airplane is a "probability cloud" existing somewhere within a trumpet-shaped volume of sky. However, this does not eliminate the fact that an airplane is a complex mechanical structure, about which the crude radar pulses can tell us very little. Deductive approaches such as Reynolds' theory just might let us determine how an electron is built out of aether grains.

One of the advantages of Reynolds' theory is that it makes possible visualization of phenomena, which formerly were grasped mainly by mathematical relationships. "Don't try to picture it; the equation is the whole reality", is a point of view which promulgates mystery in physics. Reynolds' theory has the potential of demystifying physics and bringing to bear, once again, that powerful human faculty of visualization to the subject. In this theory, the pressure of the aether, the interlocking structure of the aether grains, and dilation effects resulting from strains in the medium are the first order effects. The aether grains are the only truly 3 dimensional objects. All of the known physical phenomena are higher order effects deriving from these first order effects.

Reynolds' quasicrystalline, dilatant, subquantum medium can provide explanations for:

1. the mechanism of gravity,
2. the magnitudes of nuclear, electric/magnetic, and gravitational forces as a function of distance,
3. the constant velocity of light,
4. the Lorentz-Fitzgerald contraction,
5. time expansion,
6. increase in mass with velocity,
7. nonradiating orbits of electrons around the nucleus,
8. the Pauli exclusion principle,
9. mass-energy interconversion (pair production and electron-positron annihilation),
10. the equivalence of gravitational and inertial mass, and
11. the wave-particle duality of EM radiation.

## **SPECULATIONS ON RELEVANCE OF REYNOLDS' THEORY TO PARAPSYCHOLOGY**

Douglas Stokes in his fine review article "Theoretical Parapsychology" (15) mentions resonance theories, Sheldrake's morphogenetic fields and Bohm's implicate order as possible explanations for parapsychological phenomena.

Helmholtz demonstrated electromagnetic resonance by building identical, open loops of wire and when these were in proper orientation to each other a spark across the gap in the sender also occurred in the receiver. In some manner the energy was transmitted across the space between them. We now know that the transverse waves of electromagnetic radiation traveling through space at the speed of light are the basis for what Helmholtz observed.

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

Are mental sparks transmitted from person to person? If so, what is the nature of these mental sparks? What is the medium across which this occurs?

What might be resonating? The ganzfeld phenomena, remote-viewing would appear to involve a much more complex sort of transmission than transverse EM radiation. Osborne Reynolds' longitudinal (or compression-rarefaction) waves are one candidate. These travel at 2.4 times the speed of light, however they interact very little with matter and have a relatively limited range of a few thousand meters.

Another candidate for psi transmission lies in the structural properties of Reynolds' aether. Reynolds defines matter as regions of space within which aether grains are missing from the normal packing. This produces an aether pressure differential which, basically, is a gravitational field. This field produced by a physical object persists so long as that object exists. The field extends indefinitely into space and its intensity falls off according to the square of the distance. Along with the amorphous, purely quantitative gravitational field, it may be possible that objects produce a structured field containing more information than simply the amount of mass contained therein, which I will call "corporeal fields". Interactions of these corporeal fields extending into space might provide a physical basis for some classes of psi phenomena. Such "transcorporeal resonances" might produce subliminal or liminal experiences on a physical, tactile, body sensation level. It is not easy for many (especially the males in our culture) to be aware of, to be sensitive to, bodily sensations and "feelings". Individual differences in corporeal sensitivity could account for differences in psychic abilities.

The information in a corporeal field might be more than simply the physical configuration of a human body; it could include thoughts, sensations, feelings, and mental images. Perhaps Jung's archetypes are modes of transcorporeal resonances and the universal unconscious is a name for this corporeal field information being shared via Reynolds quasicrystalline aether.

I want to emphasize the difference between the above view and that of one person sending "thought waves" to another. The corporeal fields of all of us exist throughout the aether. Our corporeal fields in this room are coexisting and interpenetrating via the structured aether. Our bodies are the major source of these informational fields. Our bodies are separated by skin, clothing and air from other bodies in this room but we are intimately connected via the aether which provides the medium within which our bodies (and the rest of the universe) exists. Subtle features of the field could enable resonances or interactions among them which would be detectable at the source. So, I am talking about corporeal fields exchanging configurational information rather than transmission of messages through modulated electromagnetic radiation.

### **THE FUTURE OF PHYSICS AND REYNOLDS' THEORY**

The first three decades of the twentieth century were rich with theoretical advances in physics. Since that time, technology has developed the practical applications of these new theories. It seems that the lands charted by these theories have all been explored and cultivated. There



## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

remain few new vistas. Reynolds' theory offers a new perspective, a revitalized vision of the physical world, a new mastery over the physical universe. It allows for the possibility of:

1. signal propagation at 2.4 times the speed of light,
2. control of gravity or levitation of physical objects,
3. control of the inertia or mass of physical objects,
4. control of the rate of passage of time within a volume of space,
5. control of the local metric of space,
6. a space drive not requiring the expulsion of reaction mass,
7. an inexhaustible source of energy, and
8. a physical basis for understanding psi phenomena.

Considerable theoretical and applied research will be necessary to realize any of these possibilities. But just knowing that they exist will be enough to infuse new vitality into not only our physics; but also our entire civilization. Osborne Reynolds' quasicrystalline dilatant aether theory is a paradigm upon which a new physics for the third millennium may be built.

### **METAPHYSICAL IMPLICATIONS: A PERSONAL PHILOSOPHY**

Reynolds' interlocking aether grains provide a basis for long range order and structure in the universe. Macroscopic structure in past theories was based on molecular configurations and arose from the electromagnetic interactions among atoms by means of photon interchanges between electron orbitals. With the SMU these interactions themselves are based on a structured medium. Structure is no longer an accident, but is innate in the very ground of existence. Instead of an amorphous empty space we have a highly structured matrix of high energy and high information content. Instead of particles having an independent existence, we have a total embedment and interrelatedness. The medium is inside of and outside of all things. The medium is all things. Without it, nothing exists. All matter exists as dislocations in a structured, mechanical medium. All interactions between matter occur through vibrations and stresses in this structured medium. Suddenly, with Reynolds' Theory, we have a cozier universe.

For me, finding such a explanatory paradigm has changed my life. I'm basically a simple person. I like to be able to visualize things. This is why a mechanical medium appeals to me. When I say mechanical, it is important to keep in mind that although Reynolds' medium allows for the existence of matter, it itself is not ordinary matter. It has negative mass, perfect elasticity and other characteristics that everyday matter does not possess. Perhaps lifeforms have found ways of using the this structured medium to enhance their survival potential.

### **ATMAN IS BRAHMAN, BRAHMAN IS ATMAN**

This means: "The individual spirit is the universal spirit, the universal spirit is the individual spirit." What this means to me on a more personal level is that there is a unity behind the diversity of experience, the connectedness of all things, is given substance with Reynolds subquantum, interstellar medium.

## **OSBORNE REYNOLDS' SUBMECHANICS OF THE UNIVERSE: A STRUCTURED CONTEXT FOR MATTER, ENERGY, SPACE, TIME, AND PSI PHENOMENA**

The metaphysical implication of Osborne Reynolds' subquantum medium is that it is a universal matrix within which all things exist, out of which all things appear or emerge and into which all things dissolve or fade away. To use Bohm and Peat's terminology (16) it is the ultimate implicate order from which the explicate order unfolds.

The words "mother", "mater", "matrix", "hugging", "oneness", "enfoldment", "embedment" I see as descriptive of Osborne Reynolds' medium and the universe. A Universal Matrix can be considered the Universal Mater or Mother. I see a fundamental relationship between the East's "unseen ground of existence" and Reynolds' medium, which provides the implicate order, the "active intelligence", the subtle guidance which is necessary to explain hitherto unexplained physical phenomena.

As we move through the experience of life, from embedment in the womb, to embedment in the family, to embedment in the larger world of school and work, it is conceptually satisfying to see everything within which all this took place as itself embedded in the universal, subquantum, interstellar medium. This understanding at the highest theoretical, intellectual level of a graspable, visualizable grand unifying theory of everything has provided me with a ... not really faith ... how can I put it, has set my mind to rest. The subjective experience of oneness, of me, as the unifying principle of my personal universe has a theoretical correlate in Reynolds' medium as the unifying principle of the physical universe. It now all makes sense, it coheres, it is aesthetically satisfying.

Our physical bodies are conceived, born, grow, age, die and disperse. Each of us is a physical entity --- yet there is more than just these bodies. There is awareness, sensitivity to people and the world around us. There is the struggle for understanding of ourselves and our universe, the ultimate refinement of the struggle for survival, which I see as our springboard to immortality.

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